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(21) International Application Number: PCT/US95/01282 (22) International Filing Date: 31 January 1995 (31.01.95) (30) Priority Data: 193,944 9 February 1994 (09.02.94) US (71) Applicant: BOCA CHEMICALS INTERNATIONAL [US/US]; Suite 6-255, 5030 Champion Boulevard, Boca Raton, FL 33496 (US). (72) Inventor: SMITHLIN, Michael, J.; Suite 6-255, 5030 Cham- pion Boulevard, Boca Raton, FL 33496 (US). (74) Agent: CAMPBELL, Paula, A.; Testa, Hurwitz & Thibault, Exchange Place, 53 State Street, Boston, MA 02109-2809 (US).		(81) Designated States: CA, JP, KR, MX, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE). Published <i>With international search report.</i> <i>Before the expiration of the time limit for amending the</i> <i>claims and to be republished in the event of the receipt of</i> <i>amendments.</i>
(54) Title: DISC REPAIR SYSTEM (57) Abstract A composition and method are described for repairing surface defects in plastic objects, particularly laser-readable discs such as audio compact discs, video laser discs and computer memory discs. Using the composition and method, a surface defect in the disc is smoothed over and filled with a waxy material having a refractive index approximating that of the plastic substrate, thereby forming a repair which does not distract the laser and permits continued use of the disc.		

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DISC REPAIR SYSTEM

Background of the Invention

5 The invention relates to a composition and method for repairing surfaces defects, including scratches or gouges, on a plastic object, particularly on a laser-readable object such as an audio compact disc or computer memory disc.

10 Laser-readable discs store information through a series of laser-induced pits in the surface of a plastic disc. The pits are "read" by a laser and converted to a signal which is processed by a signal processor into the music, video or text which was encoded by the pits. The
15 disk on which the information is stored typically is coated with a translucent or transparent plastic layer. When this layer becomes scratched or gouged, the laser may no longer be able to read the information in the affected section, and the signal may be interrupted or distracted.
20 Depending on the seriousness of the defect, the disc may no longer be usable.

It is an object of the present invention to provide a composition and method uniquely suited to repairing
25 surface defects, such as scratches or gouges, in laser-readable plastic discs.

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Summary of the Invention

The invention is a composition useful for repairing defects on the surface of a translucent plastic object and a method for repairing a plastic object using the composition. Using the present composition and method, a scratch or gouge on the surface of the object is smoothed and filled in a single step. The composition and method are particularly useful for repairing surface scratches, gouges or other defects on laser-readable objects, such as audio compact discs, video laser discs or computer memory discs.

The composition comprises a mixture of a wax having a refractive index compatible with the refractive index of the plastic, an organic solvent, an emulsifier and an abrasive material. The abrasive material acts to smooth the edges of the scratch, gouge or other defect and the wax simultaneously fills the scratch, gouge or defect with a material having approximately the same refractive index as the plastic. The organic solvent is present to dissolve or disperse the wax, and the emulsifier is present to keep the abrasive in suspension, thereby forming a uniform, easily applied material.

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The method of the invention involves applying a composition containing a mixture of a wax, an organic solvent, an emulsifier and an abrasive material to a scratch, gouge or other defect in a plastic object such that the edges of the defect are smoothed out and the defect is filled with the wax. As a result, a laser can pass over the defect without disruption in reading the information encoded on the disc.

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Detailed Description of the Invention

A preferred aspect of the present invention provides a composition and method for repairing surface defects in laser-readable discs. The composition and method are designed to smooth the edges of the defect and fill it with a wax material having a refractive index compatible with the refractive index of the plastic material from which the disc is formed. Use of the present composition and method results in a smooth repair which does not distract the reading laser.

To accomplish this, the composition of the invention comprises a wax material selected to have a refractive index at room temperature (about 25°C) compatible with the refractive index of the plastic material which forms the disc; an organic solvent for dissolving or dispersing the wax; a mildly abrasive material for smoothing the edges of the defect; and an emulsifier for suspending the abrasive material in the composition. These ingredients are mixed together to form a liquid or paste which can be applied easily to the disc, for example, with a cloth or other applicator.

The wax can be any natural or synthetic wax which has a refractive index which is the same as or closely approximates the refractive index of the disc material. Most audio compact discs, computer memory discs (CD-ROM) and video laser discs are formed from polycarbonate, which has a refractive index at 25°C of about 1.586. Therefore, to repair a defect in a polycarbonate disc, a wax having a refractive index between 1.4 and 1.6 can be used. Waxes having a refractive index in this range include carnauba wax (1.455), polyethylene wax (1.51) or polypropylene wax (1.49), for example. A mixture of waxes also may be used.

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Such waxes are readily available from a number of sources, for example, from Reed Wax, Reading, MA. The amount of wax in the formula should be sufficient to fill the scratch or defect, and which forms a stable mixture, i.e., does not separate from the formula upon standing. Generally, an amount in the range of from about 10 to 15% by volume based on the total volume of the material is effective for this purpose.

Any organic solvent can be used provided it does not dissolve the disc material and is compatible with the wax used. Since the composition is designed to be applied by individuals, non-toxic solvents are preferred. Solvents which can be used for this purpose include, for example, mineral spirits, or non-toxic alcohols, such as ethanol or isopropanol. Such solvents are readily available from a number of sources, for example from Exxon Corporation. The amount of solvent in the formula should be sufficient to dissolve or disperse the wax, and form a stable paste or liquid. Generally, an amount of solvent in the range of from about 30% to about 60% by volume is effective for this purpose.

The emulsifier can be any surface active material which aids in forming a stable emulsion or suspension of the abrasive particles in the formula. Fatty acid salts, such as calcium stearate or calcium oleate, are particularly useful for this purpose. Such surface active agents are readily available from a number of sources, for example, from Witco Corporation. The amount of emulsifier should be sufficient to form a stable emulsion, dispersion or suspension. Generally, an amount of emulsifier in the range of from about 1% to about 10% by volume is effective for this purpose.

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The abrasive material can be any abrasive compound which can polish the plastic surface without damaging it. Abrasive typically used in the glass polishing art, especially those used for polishing plastic lenses are particularly useful for this purpose. The abrasive particles preferably are less than 2 microns in diameter, and are round in shape. Platelet shaped particles can be used, but are less desirable. The amount of abrasive material used in the formula depends upon the type and morphology of the abrasive particles. For example, if the abrasive consists of large (e.g., 1-2 microns or greater) particles and/or platelet shaped particles, then less abrasive should be used. If the abrasive material consists of fine (e.g., less than 1 micron) particles and/or round particles, then more should be used. A preferred abrasive material is aluminum oxide particles having a particle size of about 0.75 microns and a round shape. Such particles are commercially available, for example, from Micro Abrasives Corporation. Generally, the amount of abrasive material in the formula preferably is in the range of from about 10% to about 50% by volume.

The composition of the invention is prepared by combining the wax, solvent, emulsifier and abrasive material to form a paste or liquid. The ingredients can be mixed in any order. A preferred method of making the composition involves melting the wax, and blending solvent and emulsifier while gently heating, then blending the melted wax and solvent mixture with agitation to form a smooth paste or liquid. The blend is allowed to cool, then is mixed with the abrasive material until a uniform dispersion is obtained.

A currently preferred formula for carrying out the present invention to repair polycarbonate discs comprises the following Formula I.

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FORMULA I

5	<u>Amount</u> <u>By Volume</u>	<u>Ingredient</u>
	11.00%	Carnauba wax (yellow flake #1, Reed Wax)
10	33.50%	mineral spirits (Coastal Pale Oil 105, Exxon Corp.)
	5.50%	calcium stearate (Witco Corporation)
15	<u>50.00%</u>	0.75 μ Al ₂ O ₃ round particles (Microgrit ³ PXA 411, Micro Abrasives Corp.)
20	100.00%	

The formula was made according to the following procedure: the wax, mineral spirits and emulsifier are blended while gently heating to form a smooth paste; the paste was allowed to cool and was blended with the abrasive particles to form a uniform dispersion.

In another aspect, the present invention comprises a method of using the composition to repair defects or scratches in plastic objects. The method involves applying the composition to the surface to be treated and gently rubbing with a soft cloth or other applicator until the defect is smoothed and filled. The abrasive material polishes and smooths the edges of the defect forming a "beveled" edge, while the wax material fills the defect. The surface then is smoothed over and any excess material carefully removed. Alternatively, the composition first may be applied to a cloth or other applicator, and then applied to the surface to be treated.

The following example describing the repair of laser-readable audio compact discs using the composition proves

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the efficacy of the composition and method. Several audio compact discs were provided which had been scratched with a sharp object to produce scratches and gouges on the surface thereof sufficient to cause skipping or
5 interruption of the recording. Each disc was played on a compact disc player to confirm that the defect caused skipping or interruption of the sound. The scratches were examined under a stereoscopic microscope to visually note their severity. Each disc then was treated by applying a
10 small amount of the composition of Formula I to the scratched area, and rubbing gently with a soft cloth. The progress of the repair was observed under a stereoscopic microscope. The disc was considered "repaired" when the edges of the scratch were beveled or rounded and the
15 scratch itself filled in with the composition, which was verified visually under the microscope. Each disc was replayed on the same compact disc player. As a result of the treatment, each disc played without skipping or interruption in the repaired area.

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Equivalents

One skilled in the art will be able to ascertain many equivalents to the specific embodiments of the invention
25 described herein. Such equivalents are intended to be encompassed within the scope of the following claims.

CLAIMS

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1. A composition for repairing defects on the surface of a translucent plastic object comprising a mixture of
- a wax having refractive index compatible with a refractive index of the plastic;
 - an organic solvent;
 - an emulsifier; and
 - an abrasive material.

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2. The composition of claim 1 wherein the plastic has a refractive index at 25°C in the range of 1.4460 to 1.4790.

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3. The composition of claim 1 wherein the plastic is polycarbonate.

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4. The composition of claim 1 wherein the wax is carnauba wax.

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5. The composition of claim 1 wherein the organic solvent is selected from the group consisting of mineral spirits and alcohols.

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6. The composition of claim 1 wherein the emulsifier is a fatty acid salt.

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7. The composition of claim 6 wherein the fatty acid salt is calcium stearate.

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8. The composition of claim 1 wherein the abrasive material is an oxide of a Lanthanide series element.

- 1 9. The composition of claim 1 wherein the abrasive
2 material is aluminum oxide.
- 1 10. A method of repairing a surface defect on a
2 translucent plastic object comprising
3 applying to said defect a composition
4 comprising a mixture of a wax having a refractive
5 index compatible with the refractive index of the
6 plastic, an organic solvent, an emulsifier and an
7 abrasive material;
8 wherein such application causes rough edges
9 of said defect to become smoothed and causes said
10 defect to become filled with said composition,
11 thereby forming a smooth surface over said
12 defect.
- 1 11. The method of claim 10 wherein said composition
2 comprises a mixture of carnauba wax, an organic
3 solvent selected from the group consisting of
4 mineral spirits and coastal pale oil, a fatty
5 acid salt emulsifier and an abrasive material
6 comprising aluminum oxide or an oxide of a
7 Lanthanide series element.
- 1 12. The method of claim 10 wherein said plastic is
2 polycarbonate.
- 1 13. The method of claim 10 wherein said plastic
2 object comprises a compact disc, a laser video
3 disc or a computer memory disc.

INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 95/01282

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 C08L91/06 C08J7/04 G11B7/26 B29C73/02 C08K3/22
C09D191/06

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols).
IPC 6 C08L C08J C08K G11B B29C C09J C09D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	FR,A,2 220 568 (LAKE CHEMICAL) 4 October 1974 see the whole document ---	1-13
Y	PATENT ABSTRACTS OF JAPAN vol. 012, no. 354 (P-761) 22 September 1988 & JP,A,63 106 947 (CANON INC) 12 May 1988 see abstract ---	1-13
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Information on patent family members

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